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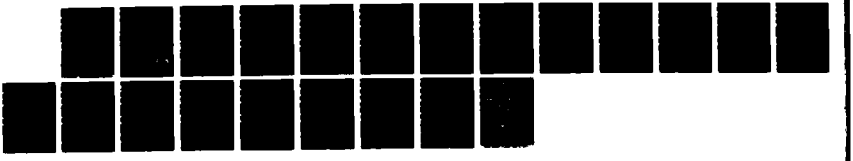

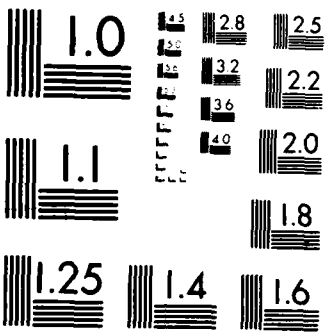
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USA-CERL ADP REPORT P-88/05
January 1988
Automation of Quality Assurance
Management Activities

AD-A192 691

Conceptual Description of a Commercial Activities Management System (CAMS)

by
Robert Blackmon
James Johnson
John Williamson

Quality assurance evaluators (QAEs) at Army installations currently spend hours of each working day arranging their inspection schedules and reporting their findings. This report outlines a concept for a Commercial Activities Management System (CAMS) which would automate much of the quality assurance (QA) planning process, allowing QAEs to spend their time inspecting instead of scheduling. In this concept, the CAMS program will have the capability to log and maintain records of work requests, maintain job-status records, sample designated job classes, schedule QA inspections, generate assignments for QAEs, record QA results, and generate contract discrepancy reports. The program could be implemented on existing IBM-compatible personal computer hardware and operated by personnel with the skills normally found in the Directorate of Engineering and Housing (DEH).

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Quality assurance evaluators (QAEs) at Army installations currently spend hours of each working day arranging their inspection schedules and reporting their findings. This report outlines a concept for a Commercial Activities Management System (CAMS) which would automate much of the quality assurance (QA) planning process, allowing QAEs to spend their time inspecting instead of scheduling. In this concept, the CAMS program will have the capability to log and maintain records of work requests, maintain job-status records, sample designated job classes, schedule QA inspections, generate assignments for QAEs, record QA results, and generate contract discrepancy reports. The program could be implemented on existing IBM-compatible personal computer hardware and operated by personnel with the skills normally found in the Directorate of Engineering and Housing (DEH).

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FOREWORD

This work was done for the Office of the Chief of Engineers (OCE) under Project 4A62781AT41, "Military Facilities Engineering Technology"; Technical Area C, "Operations and Maintenance"; Work Unit 062, "Automation of Quality Assurance Management Activities." The OCE Technical Monitor is Mr. James Gibson, DAEN-ZCF-M.

It was performed by the Facility Systems (FS) Division of the U.S. Army Construction Engineering Research Laboratory (USA-CERL). The concept was proposed by Mr. John Williamson and developed by Mr. James Johnson. Mr. Robert Blackmon assisted with the development of the concept and supervised its progress. Mr. E. A. Lotz is Chief of USA-CERL-FS. The technical editor was Ms. Jane Andrew, Information Management Office.

COL Norman C. Hintz is the Commander and Director of USA-CERL, and Dr. L. R. Shaffer is the Technical Director.

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CONCEPTUAL DESCRIPTION OF A COMMERCIAL ACTIVITIES MANAGEMENT SYSTEM (CAMS)

1 INTRODUCTION

Background

Under the Commercial Activities (CA) Program (outlined in Army Regulation [AR] 5-20[1]), an extensive conversion to contracting real property maintenance activities (RPMA) at Army installations has occurred, with an associated emphasis on quality assurance (QA) procedures to verify the contracted activities. Current QA staffs have an inadequate number of people to deal effectively and efficiently with the increased volume of contracts and inspections. The complexity of this activity is indicated by the regulations and other documents listed in the Appendix. Field observations by the authors indicate that with current staffing limits, an automated approach to the sampling, scheduling, and documentation of QA inspections in a CA context will be more convenient, productive, and cost-effective than manual procedures. Futhermore, such an automated system could be accommodated within the framework of existing procedures and microcomputer equipment.

Purpose

This report proposes a concept for an automated system for supporting the QA activities required by a CA Program. This system is intended for use by the QA managers and evaluators in the the Directorate of Engineering and Housing (DEH) and by the assigned contracting officer's representative (COR).

Approach

The CAMS program as described (in concept) in this report would provide automated support for the activities of the QAE. It would support the following activities:

- Processing of lists of maintenance and repair (M&R) jobs, and the sampling of these jobs for the inspection and statistical enforcement of contract performance
- Dynamic scheduling and assignments of QAE inspections to meet QA requirements
- Inspection reporting through the processing of QAE inspection records
- Collecting, organizing and presenting this inspection data for the COR's review
- Generating official-record contract discrepancy reports (CDRs) for the contracting officer.

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[1] Army Regulation (AR) 5-20, *Commercial Activities Program* (Department of the Army, 21 October 1986).

Chapter 2 considers the overall role of CAMS and how it fits into QA operating structures and procedures, Chapter 3 details the proposed menu interfaces and the input/output features of CAMS, and Chapter 4 summarizes the concept and provides a schedule for coding and verifying CAMS.

Mode of Technology Transfer

Technology transfer to system developers or field installation users will be accomplished by the U. S. Army Construction Engineering Research Laboratory (USA-CERL) through software and documentation, and by specialized instructions for any special or local conditions. CAMS will become part of the Integrated Facility System-Minicomputer (IFS-M), as part of Project Development Management (PDM) No. 8 for Contract Monitoring.

Two methods of technology transfer will be used. The first will use IFS-M documentation and training when the CAMS is integrated into IFS-M. The second method will provide CAMS software and documentation plus follow-on support when CAMS is used as a stand-alone. In any case, upon the release of CAMS to the field, its installation and maintenance will be supported by USA-CERL with appropriate instruction materials and by training sessions for requesting users.

2 THE ROLE OF A CAMS PROGRAM

The basic philosophy of the CA Program is that Army installations should provide for M&R services by the most cost effective method. This often results in contracting for M&R work rather than having it done by the DEH. However, the contracting approach requires close monitoring, usually with limited resources, to ensure that the work is of proper quality. Certainly, automating the QA functions will improve response times between M&R job completions and QA inspections. It is in this area that the CAMS program outlined in concept here can contribute to the effectiveness of contract administration.

Effective QA requires unbiased sampling for contract enforcement; timely scheduling so that inspections promptly follow job completions; efficient assignments of QAE daily inspections; orderly compilation of QAE findings; and recording, review, and reporting of results (especially where deficiencies occur). The general features of CAMS which will satisfy these needs are event flagging, job tracking, random sampling, multitiered scheduling, statistical interpretations, report generation, and historical record keeping.

Participation of CAMS in the QA management process is illustrated in Figures 1 and 2: Figure 1 shows the interaction between participants and Figure 2 shows functional performance. Figure 1 emphasizes the overall input/output relationships for CAMS. The top arc of the diagram identifies the contractor information interface; from this interface, contractor schedules with updates (or DEH estimates of this information) are fed from IFS into the CAMS data base; from this data base the bottom arc of QA control activities is then developed. In this plan, the iterative development of QA scheduling from the M&R planning results in inspection assignment cards which are supplied on a daily basis to the QAEs. After these inspections are made, the COR-evaluated results are supplied to CAMS, which automatically updates contractor failure records and which also will generate contract deficiency reports when requested.

Figure 2 shows some of the interactions of CAMS with important RPMA and QA functions. This diagram should be read in a clockwise direction, starting at the work reception center activity (1) at the top. (Item 0 is preliminary and takes place outside of CAMS.) The following is a walk-through of the processes shown in this figure.

0. QA management controls the automated scheduling process by means of two "preferential" listings entered before any CAMS processing takes place; these are a craft-category list and a QAE availability list which are held constant for the selected scheduling period.

1. The work reception center (either under DEH or contractor control) receives and evaluates service orders (SOs) and individual job orders (IJOs); this new job information is provided to CAMS after IFS-M validation.

2. The Contractor schedules the M&R, preventive maintenance (PM), and standing operations order (SOO) responsibilities and provides a list to the QA managment.

3. CAMS initially produces QA sampling lists, then creates an integrated list, followed by a monthly inspection schedule for QAE planning. Times used in developing the schedule are based on average construction experience at that

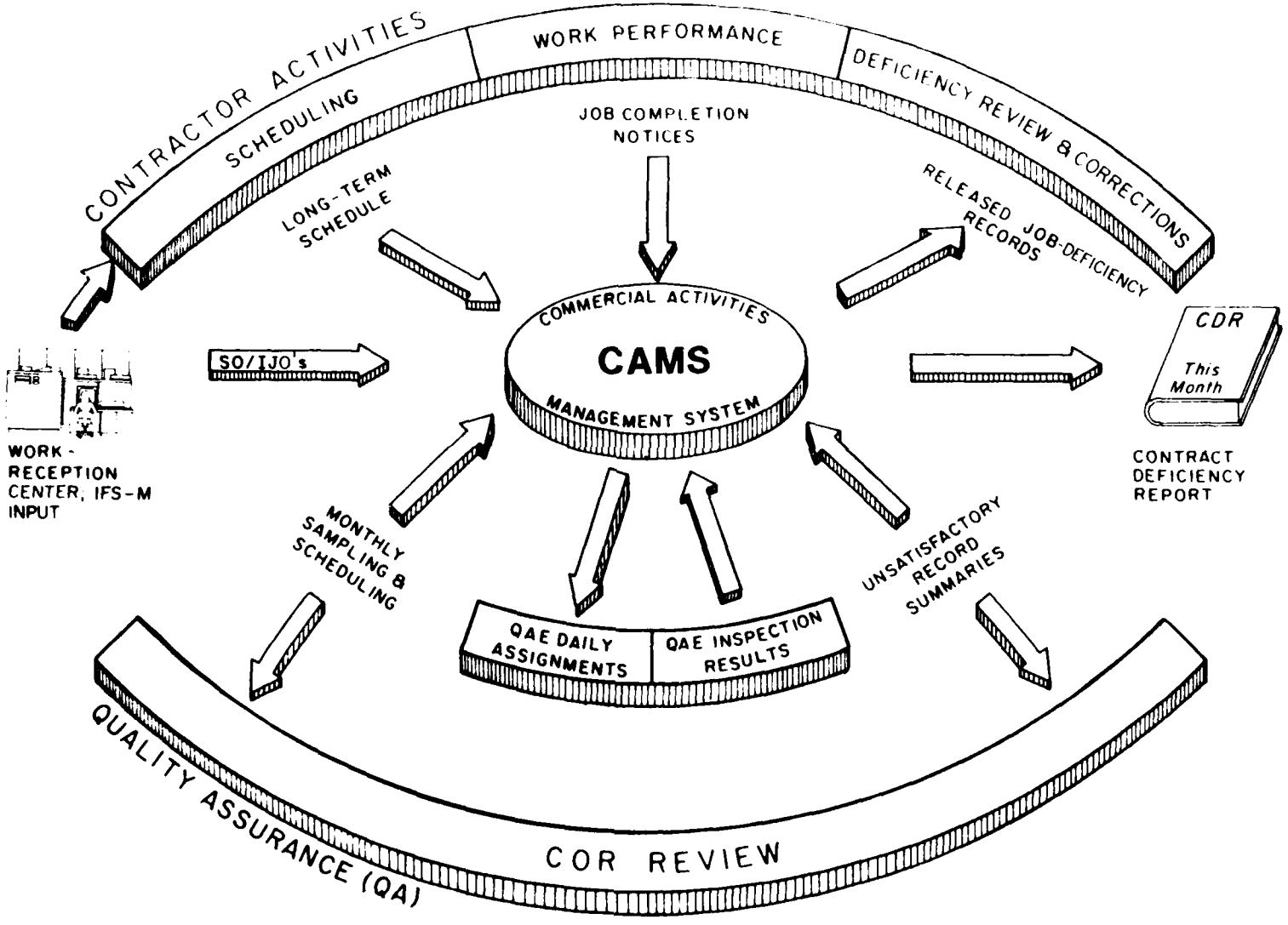

Figure 1. Overall input/output (I/O) relationships for the Commercial Activities Management System (CAMS).

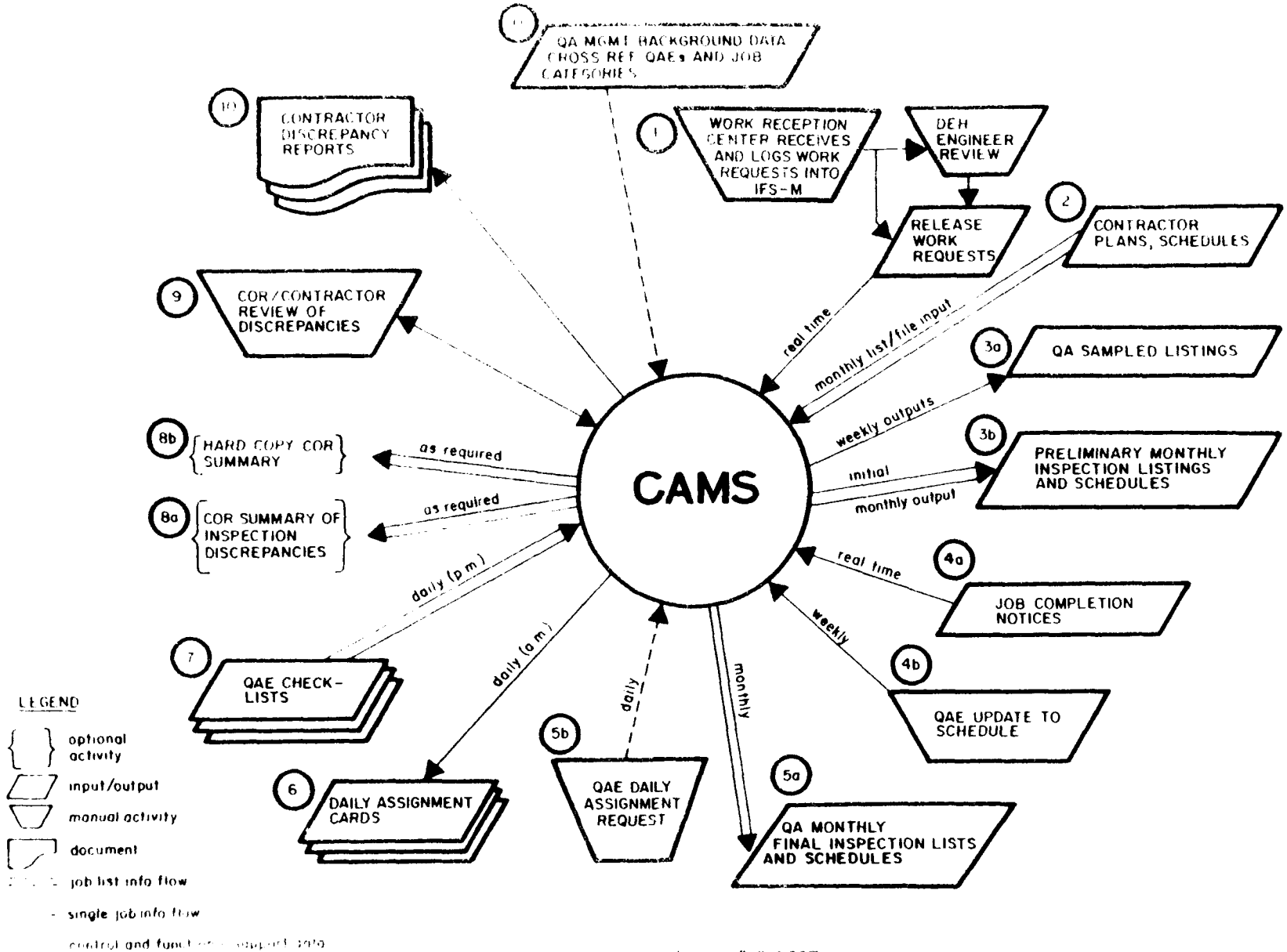

Figure 2. Interactions of CAMS.

installation. QA management may review this tentative planning and allow it to stand, or may decide start over (item 0).

4. QA management enters firm completion dates from the contractor's schedule (or completion notices) and CAMS adjusts the QA scheduling accordingly.

5. QA planning lists and schedules are generated and studied.

6. Assignment cards are issued in the morning to each QAE to identify the inspection work for the day; every QAE is given inspection assignments for each day considering availability, applicability (specializations), urgency, and location. The QAE then picks up the checklists required for the assigned work and perfoms each inspection task in the order specified.

7. After job inspections are completed, all QAEs' checklists are recorded in the CAMS data base; if the assignment card was not completed, checklists will be missing and CAMS will reschedule the job(s) for a following day. Unsatisfactory reports are reviewed by the COR before these data are released from CAMS for general or contractor distribution.

8. QAE inspection-discrepancy record summaries may be generated on request for COR review.

9. COR/contractor coordination reviews are held to identify and verify discrepancies.

10. CDRs and special reports then will be generated by CAMS when requested by the COR.

3 OPERATING FEATURES

CAMS will be designed and developed to provide flexible support to QA management at U.S. Army installations. Users will be able to choose how extensively they make use of CAMS outputs. For example, the QA manager may use the computer generated job list but develop a schedule manually. The optional levels of CAMS use will be controlled by the DEH or by QA management.

Interface Menus

Figure 3 shows how a menu hierarchy guides the first time or occasional user; any consistently used capabilities may be accessed by the user directly. Selection menus (Figure 3) are a convenience which are provided for occasional access by the DEH management, the COR, and the in-house work receptionist. Interrogation menus, on the other hand, prompt the user for information which must be supplied to avoid a default response.

Functional Services

In this concept, IFS/CAMS provides the following services to support QA activities.

Work-Reception Desk (optional)

- Logging of work requests, automatically verifying that they have complete information and do not duplicate other work.
- Job-status tracking by each day or from a total active list; compilation of job completion statistics.
- Contractor planning and job data links to permit timely inspection scheduling.

QA Management Services

- Job sampling from default or user-controlled algorithms.
- Immediate, complete inspection scheduling; automated scheduling of personnel and equipment (by month or week).
- Individual QAE inspection scheduling; automated computations of assigned inspection times vs. available workday time (by week or day).
- Generation of daily assignment cards for each QAE at start of day (SOD); each entry dependent on the receipt of a job-completion notice from the contractor.
- Reading and recording of inspection checklist or bar-code records at the close of business (COB) of each day for each QAE.
- Generation of a summary of unsatisfactory checklist entries for COR/QAE review (daily).

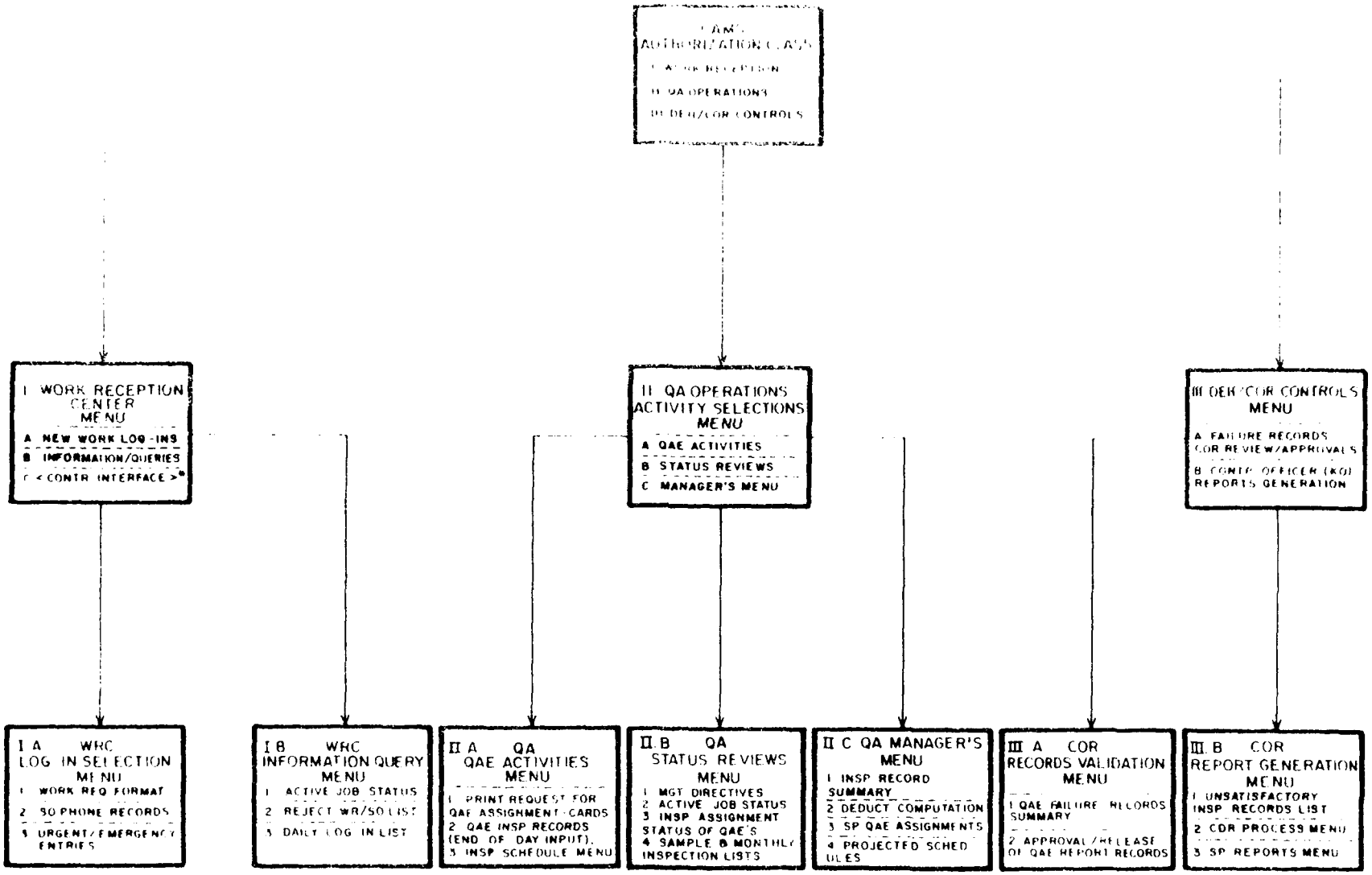

Figure 3. Selection menus hierarchy (example only).

COR Support

- Display of records of unsatisfactory inspection results, for review/approval.
- Real time status updating and recordkeeping, including the contractor's rating and statistics on facility component/element failure rates.
- Complete QA reports generation; contract discrepancy reports generated for submittal to the contracting officer.

Figure 4 shows the proposed functional support of CAMS to DEH/COR/QAE activities. This is a sequential, functional-flow diagram in a situation where the DEH has the responsibility for work reception.

To start, as incoming SOs or work requests are received at the DEH work reception desk, CAMS generates a work order list of the verified work requests. From this, the RPMA contractor prepares an update to his existing (long-term) M&R schedule of cyclic (PM/SOO) jobs and any uncompleted SO/IJOs. The COR submits the updated contractor schedule to CAMS. A list of active SO/IJOs to be completed during the coming week is also maintained by CAMS. All IJOs and a sampling of the SOs to be completed during the week are reviewed for QA testing by the COR, who then submits this listing to CAMS for developing QA and QAE schedules. A direct product of the daily inspections listings in the weekly schedules (generated for individual QAE's) is the daily assignment cards which are developed for each facility component group or contract line item number (CLIN), and are provided at the start of the day to each QAE. These cards with their inspection results for the day are used for QAE COB reporting. These inspection results will be processed by CAMS into outputs suitable for review by QAE/COR. When such records are approved by the COR, they will be entered into the CAMS data base for record keeping and failure report generation.

Other Services

A CAMS data base will be a source of RPMA/QA reference and job status information, which can be made available to authorized terminals and requesters. Some outputs potentially available from CAMS are shown in Table 1. For such outputs to be useful, inputs must be current and accurate. With CAMS fully integrated into COR/QAE operations, this should be the case.

Hardware and Software Requirements

The functional and data base requirements for CAMS are well within the existing DEH capabilities. Hardware support may be met by the IBM PC AT (or compatible) and a dot matrix printer. No data base support procedures will be required which are significantly different from current commercially available systems (such as dBase III).

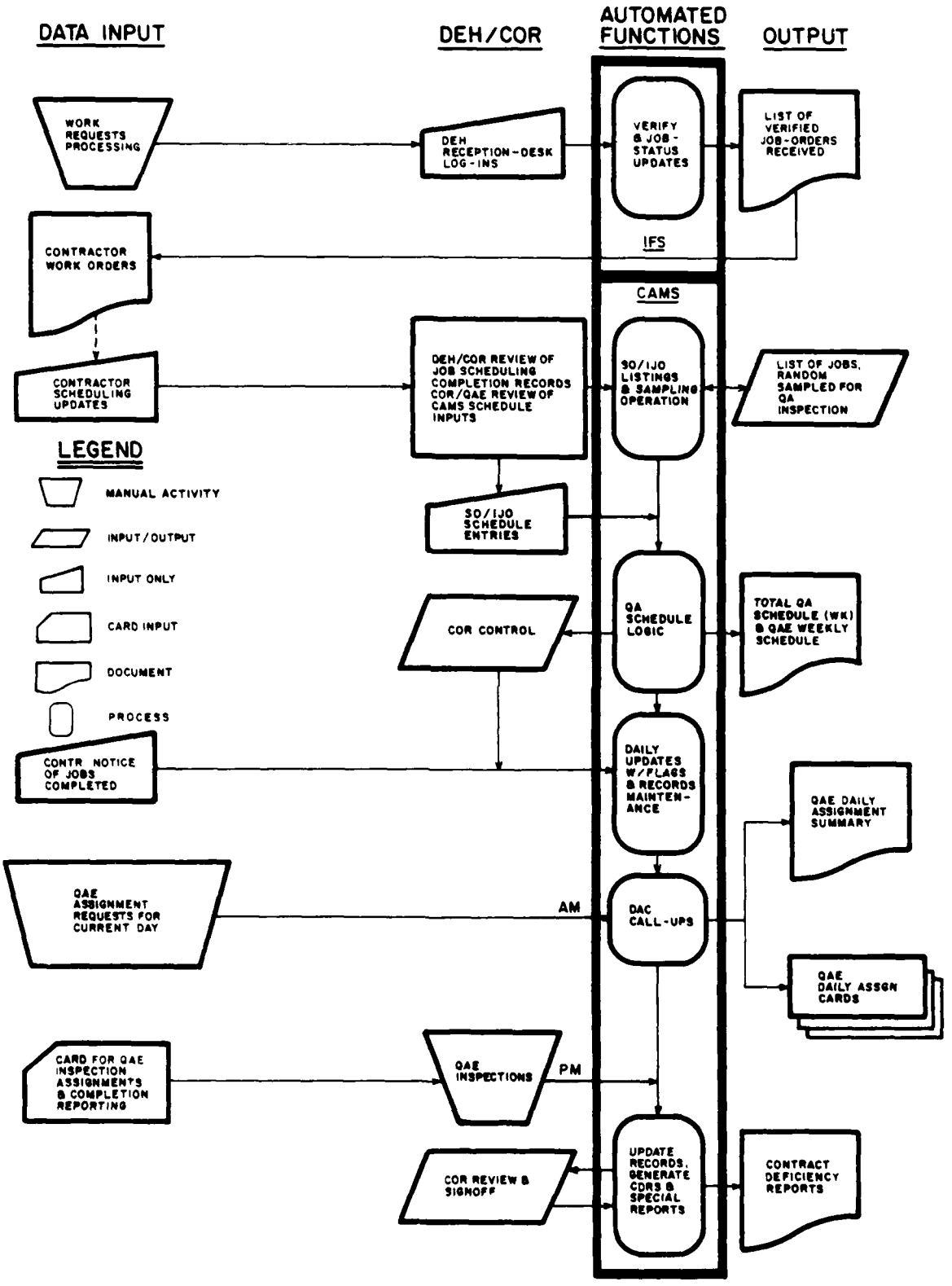

Figure 4. Functional services of CAMS in support of DEH/COR activities.

Table 1

CAMS Interactive Outputs
(Possible Extensions to Basic System)

Type of Add-On Outputs	Output Information Provided	I/O Controller	Input Data Types
QAE INSPECTION STATUS (restricted) by component-type	Scheduled inspections - dates - man/equipment hours	COR/QAE	QA schedule dates for sampled SO jobs
CONTRACTOR JOB STATUS	Job completion date; scheduled date or hold status; QA inspection and acceptance dates	Contractor	Schedule dates on SO/IJO/ special jobs
WORKLOAD STATUS by date of performance	Component/element job-types - number of jobs - man-hours - equipment hours - material quantities	Contractor	Schedule dates for SO/IJO/ special jobs
RPMA-Contracting cost estimates by job/facility-component	Job/materials - dollar level - man/equipment hours - quantities	Contractor	Schedule costs for IJO/SOO jobs
STATISTICAL SUMMARIES by fac-component/ fac-element/ facility ID	Failure & repair current statistics (for the data base)	COR	Contractor performance records
ELECTRONIC BULLETIN BOARD by job/date or sender	Facility/job flags - caution/notices MFR's, etc.	DEH/COR/QAE	Electronic Mail

4 CONCLUSIONS AND PLANNING

Conclusions

The Commercial Activities Management System (CAMS), as proposed, will be effective and easily implemented. It will meet the scheduling, procedural and reporting needs of the quality assurance evaluators (QAEs), and strengthen the management activities of the contracting officer's representative (COR). The existing microcomputer hardware at most installations will support CAMS, which can be installed with minimum disruption to ongoing work. Further, CAMS is geared for the skill level of existing personnel.

The services provided by CAMS allow a controlled and efficient performance of QA operations. This support is flexible and can be used to whatever extent is preferred by the DEH. Sampling, for instance, can be applied to service orders or any other type of work order on demand; QA scheduling may be by the month, week, or day, or all three; the type and format of output reports also may be prescribed.

Schedule

Coding, verification, and installation testing of a prototype CAMS and final product releases are scheduled in Table 2. General distribution of the released program is expected by June 1988.

Table 2

Estimated Completion Schedule for CA Management System Program Development

Concept development	16 February 87
Users Group Review (start date)	31 March 87
Functional Description developed; requirements defined	01 May 87
Coding and subroutine developments	1st Qtr. FY88
Installation of CAMS prototype at selected test site(s)	2nd Qtr. FY88
Deliverable CAMS development and release	3rd Qtr. FY88

APPENDIX:

REFERENCES FOR THE COMMERCIAL ACTIVITIES QUALITY ASSURANCE PROCESS

Army documents:

AR 5-20	Commercial Activities Program (DCSOPS)	10/86
AR 18-3	Automatic Data Management Information Systems	11/71
AR 18-7	Automatic Data Processing Management Review Program	11/84
AR 25-1	Army Information Management Program	3/86
AR-335-1	List of Recurring Management Information Requirements	3/86
AR-335-15	Management Information Control (TAGO)	12/82
AR 420 Series	Facility Engineering (USACE)	---
DA Pam 715-15	Service Contract Administration	3/86
MIL-STD-105D	Sampling Procedures and Tables for Inspection by Attributes	3/64
MIL-STD-500D	Military Standard for 3 of 9 Barcode	---

Facilities Engineering Support Agency (OCE):

FESA P-10	DEH Service Contract Guide	3/85
IFS VOL. III	FE Management System (FEMS) Module	(In revision)

Office of Management & Budget:

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Supplement 1:	Performance of Commercial Activities	---

USA-CERL Technical Reports (TR):

TR P-85/04	Guide for Quality Assurance Inspection of Commercial Activities Contracts for Real Property Maintenance Activities	11/84
TR P-85/04 Supplement 1	Same	7/86

LIST OF ACRONYMS

AR	Army Regulation
CAMS	Commercial Activities Management System
CA	Commercial Activities
CDR	contract discrepancy report
CLIN	contract line item number
COB	close of business
COR	contracting officer's representative
DEH	Directorate of Engineering and Housing
IFS-M	Integrated Facility System-Mini(computer)
IJO	individual job order
MFR	memorandum for the record
M&R	maintenance and repair
PM	preventive maintenance
QA	quality assurance
QAE	quality assurance evaluator
RPMA	real property maintenance activities
SO	service order
SOO	standing operation order
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